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Territorial Planning Regulations and Instruments in Sustainable Mobility. Study Case: Quitumbe - Ecuador

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***Abstract*—** The integration of mass transit systems with immediate urban planning remains a critical challenge for regional urban sustainability in Latin America. In Quito, Ecuador, despite the implementation of the new Metro system, the strategic Quitumbe multimodal station suffers from severe traffic congestion, road insecurity, and deficient pedestrian infrastructure. Objective: This study analyzes sustainable mobility in Quitumbe by evaluating the application of Transit-Oriented Development (TOD) principles and comparing local regulations—such as the Sustainable Mobility Master Plan (PMMS 2024-2042)—with international sustainability standards. Methodology: Adopting a qualitative, descriptive, and documentary approach, this research evaluates local planning instruments (PMDOT and PUGS) against international benchmarks like the ITDP TOD Standard, assessing gaps in urban densification, land-use mix, and active mobility. Results: The comparative analysis reveals significant regulatory vacuums in the PMMS regarding neighborhood integration, the activation of strategic urban voids, and the monitoring of intermodal performance. Consequently, the study proposes actionable interventions, including a Neighborhood Integration Corridor, an urban void reuse program, and the establishment of the "Quitumbe Intermodal District" as a specialized territorial management unit. Conclusions: While the Quito Metro functions effectively as a transit backbone, local planning lacks the micro-level instruments necessary to operationalize TOD principles on the surface. Transitioning from generalized mobility guidelines to specific, data-driven territorial tools is essential to transform Quitumbe into a safe, compact, and inclusive urban centrality that aligns with Sustainable Development Goal 11 (SDG 11).

Keywords: Territorial planning, urban planning, land management, territorial sustainability.

INTRODUCTION

This research addresses Sustainable Mobility in Quitumbe linked to the Quito Metro system, through the Application of Transport-Oriented Development (DOT) at the Quitumbe station of the Quito Metro, a strategy regulated by the Sustainable Mobility Master Plan (PMMS 2024-2042). Urban mobility in the area of influence of Quitumbe Station in Quito, Ecuador, is characterized by traffic congestion, road insecurity, deficiencies in pedestrian infrastructure, and lack of adequate signage (UIDE, 2025). The central problem of this research is the lack of integrated urban planning that articulates the Quito Metro with sustainable urban development at the Quitumbe station, determining the lack of application of Transport-Oriented Development (DOT) in the area of study (Toaquiza Cuchiparte, 2023).

Consequently, the objective of this study is to analyze sustainable mobility in Quitumbe linked to the Quito Metro, with the application of Transport-Oriented Development (DOT) in the Quitumbe station of the Quito Metro, identifying the main deficiencies of urban regulations, comparing with local regulations with international standards of Sustainability.

In the Latin American context, the most significant problems are the dynamics of the city aimed at the preference of the automobile and the growth of the vehicle fleet, given that there are long travel times, polluting emissions and difficulty of access to public transport, generating a negative impact on the efficiency and effectiveness of urban sustainability (Toaquiza Cuchiparte, 2023, p. 53). Inadequate urban planning generates unsustainable mobility, where the lack of coordination between transport and planning territorial is the main challenge in the Latin American region (Santamen Nuñez & Tuero, 2021).

In response to these problems, international organizations such as UN-Habitat and the Institute for Transportation and Development Policy (ITDP) establish criteria for walking, pedaling, connecting, transporting, mixing and compacting, as a basis for evaluating the quality of life and connectivity of intermodal nodes. Its Sustainable Development Goal (SDG), in particular SDG 11, sustainable cities and communities, with an emphasis on mobility, accessibility and governance. It includes the New Urban Agenda and sustainable urban mobility plans (SUMP), which promote compact, inclusive, and connected cities "One of the main Latin American problems corresponds to the growth of the vehicle fleet and the lack of integrated urban planning, directly affecting urban sustainability and the efficiency of public transport" (Toaquiza Cuchiparte, 2023, p. 53).

In the national context in Ecuador, the National Sustainable Urban Mobility Policy 2023, which establishes the reduction of polluting emissions, priority for public and non-motorized transport, and the inclusion of priority groups (people with disabilities and the elderly). Sustainable urban mobility is an issue that is included in the Territorial Development Plans of cities, through the integration of the social, economic and environmental aspects of the urban environment (Vega Betancourt, 2023). A sustainable model of urban mobility must ensure the protection of the environment, maintain social cohesion and the quality of life of citizens and promote economic development (UPV, 2023).

In the cantonal context, there have been several mobility projects for Quito that contained the vision of a sustainable and sustainable transport system that took the Trolleybus Corridor as their backbone, but these public policies have not yielded the expected results, causing the city not to continue on the path towards a zero-emission metropolis. a path that began in 1995 (Caña, 2022). Environmental problems in Quito One of the biggest environmental problems is the controversy of the air, a product of gases emanating from automobiles, the lack of urban planning encourages unsustainable mobility, the current mobility system is not efficient (FLACSO, 2017).

In the context of the Metropolitan District, the research project addresses the problem of urban mobility in influence of the Quitumbe Terrestrial Terminal in Quito, Ecuador, characterized by traffic congestion, road insecurity, deficiencies in pedestrian infrastructure, lack of adequate signage (UIDE, 2025). This paper seeks to analyze the factors that influence urban mobility in Quitumbe, aimed at proposing alternatives that encourage pedestrian travel while reducing the use of private vehicles within a sustainable mobility system that articulates the study area (Vega Betancourt, 2023).

MATERIALS AND METHODS

a. Sustainable mobility in Quitumbe

Sustainable mobility is an urban planning model that promotes safe, accessible, and efficient travel, prioritizing public transport and active mobility to reduce environmental impacts and improve the quality of life of the population (Vega Betancourt, 2023). In Latin America, the growth of the vehicle fleet and dependence on private vehicles have generated problems of congestion, pollution, and inequality in access to urban opportunities, evidencing the need to integrate transport with territorial planning (Santamen Núñez & Tuero, 2021).

In Quito, the Quito Metro constitutes the main mass transport infrastructure, strengthening urban connectivity and improving accessibility between different sectors of the city (EPMMQ, 2021). However, to maximize its benefits, it is necessary to link transportation with urban development through the Transportation-Oriented Development (DOT) model, which promotes compact, walkable, and mixed-use communities around public transportation stations (Toaquiza Cuchiparte, 2023).

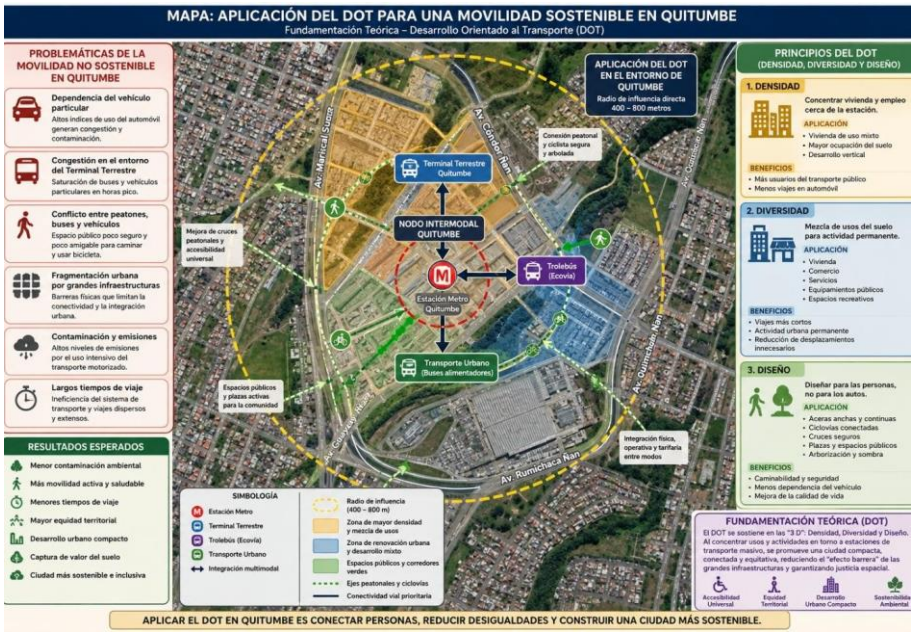

Figure 1. Urban Analysis "Quitumbe Quito Metro"

DOT is based on the principles of density, diversity, and design, known as "3D," which seek to concentrate urban activities near stations, encourage the mix of land uses, and prioritize safe and accessible public spaces (Cervero & Kockelman, 1997). Likewise, walkability and road safety are essential elements to encourage pedestrian travel and ensure safe and inclusive urban mobility (UN-Habitat, 2020).

The Quitumbe station is a strategic multimodal node as it integrates the Quito Metro, the Trolleybus, the Ecovía, urban routes and the Interprovincial Terrestrial Terminal, becoming an ideal space for the application of DOT (Toaquiza) principles.

In addition, international organizations such as UN-Habitat and ITDP promote compact cities oriented towards public transport, in accordance with Sustainable Development Goal 11 (SDG 11) (UN-Habitat, 2020).

At the local level, the Sustainable Mobility Master Plan 2024-2042 (PMMS), the Metropolitan Plan for Development and Territorial Planning (PMDOT) and the Land Use and Management Plan (PUGS) establish guidelines to strengthen sustainable mobility and the integration between transport and urban development (Municipality of the Metropolitan District of Quito, 2024). Consequently, the application of the DOT at the

Quitumbe station represents a key strategy to improve accessibility, reduce dependence on private vehicles and promote more sustainable and inclusive urban development.

b. Related Models

The related models for intervention in the Quitumbe sector converge in a comprehensive vision of urban development aimed at improving accessibility, connectivity and territorial sustainability. Firstly, the Urban Cell Model or "15-Minute Centrality" proposes a reconfiguration of the territory through the mixture of land uses and the concentration of public facilities within a walkable radius of 400 to 800 metres, favouring proximity to essential services and reducing the need for motorised travel (Gualotuña & Macas, 2024).

In addition, the Multimodal Management and Integration Model strengthen the articulation of the different transport subsystems, integrating surface feeder networks with high-capacity systems such as the Quito Metro, consolidating more efficient and connected mobility on an urban scale (GAD DMQ, 2023).

Finally, the Active and Inclusive Mobility Model or "Last Mile" reinforces this strategy through the implementation of segregated cycling infrastructure, safe pedestrian spaces and road calming measures that facilitate non-motorised access to transport stations and terminals, guaranteeing a safe connection, accessible and inclusive for all users (GAD DMQ, 2023; Gualotuña & Macas, 2024).

Together, these models constitute a complementary framework of reference to promote sustainable, integrated and people-centered mobility in the surroundings of the Quitumbe Land Terminal.

c. Methodology

The methodology applied in the research adopts a qualitative approach of a descriptive and documentary nature, aimed at the analysis of the application of the Transport-Oriented Development (DOT) model in the Quitumbe station of the Quito Metro.

For the development of the study, a bibliographic and regulatory review of official documents related to territorial planning and sustainable mobility was carried out, including the Metropolitan Plan for Development and Territorial Planning (PMDOT) 2024-2033, the Land Use and Management Plan (PUGS), the Metropolitan Ordinance PMDOT-PUGS No. 003-2024 and technical documents issued by the Metropolitan Public Company Metro de Quito.

Subsequently, a comparative analysis of the principles of the DOT model was carried out, such as accessibility, modal integration, pedestrian mobility, efficient land use and strengthening of public transport, contrasting them with the urban and functional characteristics of the Quitumbe sector. Finally, the relationship between mass transport infrastructure and current territorial planning instruments was evaluated, identifying the main contributions of the Quito Metro to the sustainable urban development of the Metropolitan District of Quito.

Additionally, a critical analysis of the Metropolitan Plan for Development and Territorial Planning (PMDOT) 2024-2033 and the PUGS of the Metropolitan District of Quito was carried out, identifying the existing limitations in the incorporation of specific criteria of Transportation-Oriented Development (DOT). These instruments were compared with international standards of sustainable urban planning, particularly the "TOD Standard" developed by the Institute for Development and Transport Policies (ITDP), used in cities such as Curitiba, Medellín, Bogotá and Mexico City.

This analysis made it possible to identify gaps related to indicators of urban densification, mix of land uses, reduction of automobile use and strengthening of active mobility, proposing complementary guidelines that allow adapting the best international practices to the context of the Quitumbe station.

RESULTS

From the comparative analysis carried out between the Sustainable Mobility Master Plan (PMMS), the principles of Transport-Oriented Development (DOT) and international standards of sustainable urban planning, various limitations were identified in the application of specific strategies to consolidate Quitumbe as a sustainable urban centrality linked to the Quito Metro.

The results show that, although the PMMS incorporates general guidelines aimed at improving urban mobility, there are still gaps related to neighborhood integration, the activation of strategic urban spaces, the monitoring of intermodal nodes, the articulation between territorial planning and mass transport, as well as the quality of the public space around the Quitumbe station.

Based on the observations identified and the comparison made with international benchmarks of Transport-Oriented Development (DOT), strengthening proposals were formulated aimed at complementing the guidelines of the Sustainable Mobility Master Plan (PMMS) and contributing to the consolidation of Quitumbe as a sustainable, accessible and integrated urban centrality. Table 1 presents the main problems identified, the weaknesses detected in the current planning instrument, the international benchmarks analyzed, and the proposals put forward for their strengthening.

Table 1. Results of the analysis of results with their respective impact

Problems identified in Quitumbe	**Weaknesses of the PMMS**	**Proposal strengthening (own elaboration)**	**Expected impact**
Poor integration between the nearby neighborhoods and the Metro-Terminal Terrestre node.	The PMMS does not establish specific projects of neighborhood articulation around strategic stations.	Implement the Quitumbe Neighborhood Integration Corridor, connecting the surrounding neighborhoods with the Metro station and the Terrestrial Terminal.	Greater pedestrian accessibility, reduction of motorized trips and strengthening of territorial integration.
Existence of empty land or underutilized spaces around of the node of transport.	The PMMS does not contemplate specific mechanisms to activate Nearby strategic spaces to the Metro.	Develop a void reuse program urban areas intended for the creation of green urban areas, community facilities and living spaces for users of public transport.	Improvement of the landscape urban and efficient use of the soil.
Missing of monitoring of the performance of Quitumbe as a centrality of mobility.	The PMMS lacks specific indicators to evaluate intermodal nodes.	Create a Sustainable Mobility Indicator System for Quitumbe that evaluates accessibility, connectivity, road safety, active mobility and use of transport public.	It facilitates decision-making and permanent monitoring of sustainable mobility.

Weak relationship between urban planning and operation of the system of mass transport.	The PMMS addresses mobility in a sustainable way to general without specific instruments for metropolitan centralities.	Create the Quitumbe Intermodal District as a special territorial planning unit that coordinates urban development with the operation of the Metro and the Terminal Terrestrial.	Consolidation of Quitumbe as a strategic centrality of the south of Quito.
Insufficient public spaces for users and pedestrians.	The PMMS prioritizes mobility but does not develop detailed criteria for public space in high-demand stations.	Implementing a network of public connection spaces incorporating urban squares, street furniture, green areas and rest areas around the station.	Increased urban quality, security and appropriation of public space.

The analysis of sustainable mobility in influence of the Quitumbe station of the Quito Metro reveals a critical disconnection between high-capacity mass transit infrastructure and immediate territorial planning. Although the Sustainable Mobility Master Plan (PMMS 2024-2042) and national policies in Ecuador—such as the National Sustainable Urban Mobility Policy 2023—theoretically promote the prioritization of public and active transport, the results demonstrate that local regulatory tools lack the specific instruments required to operationalize the principles of Transit-Oriented Development (TOD) in large-scale intermodal nodes. This regulatory vacuum perpetuates the problems identified by UIDE (2025), where the surroundings of the Quitumbe Terrestrial Terminal remain characterized by traffic congestion, road insecurity, and severe deficiencies in pedestrian infrastructure.

This lack of neighborhood integration validates the assertions of Santamen Núñez and Tuero (2021) regarding the historical lack of coordination between transport and territorial planning in Latin America, which remains the main challenge for regional urban sustainability. While the Quito Metro operates efficiently underground (EPMMQ, 2021), its surface area behaves as an isolated island. In response to this, the proposed "Quitumbe Neighborhood Integration Corridor" directly addresses the criteria of walking and connecting established by UN-Habitat and the ITDP. By contrasting local conditions with international benchmarks like the TOD Standard, it becomes clear that the success of the station should not be measured solely by passenger flow, but by its capacity to guarantee non-motorized accessibility and reduce private vehicle dependence in the crucial "last mile" (GAD DMQ, 2023).

Furthermore, the presence of vacant lots and underutilized spaces around the terminal indicates that Quitumbe is failing to meet the "3D" principles (Density, Diversity, and Design) articulated by Cervero and Kockelman (1997). PMMS's failure to incorporate activation mechanisms for these strategic spaces allows the degradation of the urban landscape to persist, increasing the security and environmental risks warned of by Vega Betancourt (2023). Implementing an urban void reuse program would not only optimize land use but also catalyze the transition toward the "15-Minute Centrality" model (Gualotuña & Macas, 2024). Transforming these gaps into green areas and community facilities directly supports SDG 11, transforming a site of mere transit into a compact, liveable, and socio-economically cohesive community space, while simultaneously mitigating the severe air pollution issues noted by FLACSO (2017).

From a governance perspective, the results highlight a structural weakness regarding the integration of urban planning and mass transit operations. Historically, Quito's mobility policies have failed to yield expected results over time, preventing the city from advancing toward a zero-emission metropolis (Caña, 2022). This research suggests that such failures occur because mobility plans address the territory too broadly, without specific management instruments for metropolitan centralities. The proposed creation of the "Quitumbe

Intermodal District" as a special territorial planning unit is a fundamental shift. Regional reference cities like Medellín or Bogotá demonstrate that major transit hubs require exceptional urban regulations—such as mandatory mixed-use and higher densification indexes. Without a specialized management figure, the guidelines of the Land Use and Management Plan (PUGS) will remain insufficient to consolidate southern Quito's primary node.

Finally, the lack of performance indicators within the PMMS prevents data-driven decision-making regarding the evaluation of intermodal nodes. The proposed Sustainable Mobility Indicator System fills this regulatory gap by systematically monitoring accessibility, road safety, and active mobility. This metric reinforcement must be accompanied by a physical overhaul of the public space. As emphasized by UPV (2023), a sustainable model must safeguard urban quality of life; therefore, implementing a network of squares, street furniture, and pedestrian rest areas is not an aesthetic consideration, but a structural necessity. To curtail the growth of the vehicle fleet and private vehicle abuse highlighted by Toaquiza Cuchiparte (2023), the terminal's surroundings must be redesigned to prioritize human scale, security, and civic appropriation.

CONCLUSIONS

The Quitumbe station is a strategic centrality for the sustainable mobility of the Metropolitan District of Quito, due to the integration of the Quito Metro, the Land Terminal and the urban transport systems, consolidating itself as a key node for the connectivity of the south of the city.

The analysis of the Sustainable Mobility Master Plan (PMMS) showed that, although it establishes general guidelines for sustainable mobility, it has limitations in the incorporation of specific criteria of Transportation-Oriented Development (DOT), especially in aspects related to neighborhood integration, urban densification and active mobility.

The comparison with international standards of sustainable urban planning made it possible to identify the need to strengthen the articulation between public transport, land use and public space, to consolidate more accessible, compact and inclusive urban environments around the Quitumbe station.

Incorporate in future updates of the PMMS specific criteria of the Transportation-Oriented Development (DOT) model, including indicators of pedestrian accessibility, active mobility, urban densification and mix of land uses in areas of influence of mass transit stations.

Implement neighborhood integration corridors that safely and efficiently connect the surrounding neighborhoods with the Quitumbe station, through pedestrian infrastructure, bicycle lanes, signage and adequate lighting.

Develop programs for the reuse of empty land and underused spaces around the station, allocating them to public spaces, green areas and community facilities that strengthen the urban quality of the sector.

Establish a permanent monitoring system and indicators of sustainable mobility that allows evaluating the performance of Quitumbe as an intermodal node and supporting decision-making for territorial and urban planning.

Conflict of Interest Statement

The authors declare no conflicts of interest regarding the research, authorship, and/or publication of this article.

Ethical Approval / Informed Consent Statement

This study used documentary and regulatory information, public statistical data, and field observation in open spaces, without involving human subjects or identifiable personal data. Therefore, individual informed consent was not required. All information was handled in accordance with research ethics principles and good practices, avoiding disclosure of sensitive data and respecting regulations on access to public information.

REFERENCES

Metropolitan Council of Quito. (2024). PMDOT-PUGS Metropolitan Ordinance No. 003-2024: Update of the Metropolitan Plan for Development and Territorial Planning and Land Use and Management Plan of the Metropolitan District of Quito. Municipality of the Metropolitan District of Quito.

Municipality of the Metropolitan District of Quito. (2024). Metropolitan Development and Territorial Planning Plan 2024-2033. Decentralized Autonomous Government of the Metropolitan District of Quito

Empresa Pública Metropolitana Metro de Quito. (2024). Quito Metro System and sustainable mobility. Quito Metro.

Development Bank of Latin America and the Caribbean (CAF). (2024). First line of the Quito Metro. CAF. Bielsa, J. C. T. (2013b). New planning and management tools for urban rehabilitation and regeneration. Revista Aragonesa de Administración Pública/Revista Aragonesa de Administración Pública, 15, 27-72. https://doi.org/10.71296/rarap.513

Omar, G. E. J., & Mariona, G. M. (2026). Learning from the city: challenges and opportunities from university training in architecture and urban design to promote more sustainable urban development in the metropolitan area of Monterrey. Dialnet (University of La Rioja). https://dialnet.unirioja.es/servlet/oaiart?codigo=10734698

Efrain, T. C. W. (2023). Evaluation of the standard of transportation-oriented development at the Labrador and Quitumbe stations of the Quito metro, 2023. https://repositorio.uti.edu.ec/items/5809bb87-fe6e-46f4-8cb7c028b4454383?utm_source

Organic Law on Territorial Planning, Land Use and Management (LOOTUGS). (2016). Official Register Supplement 790. National Assembly of the Republic of Ecuador. gobiernoelectronico.gob.ec

Gualotuña, D. A., & Macas, J. P. (2024). Evaluation of the standard of transportation-oriented development (DOT) in the vicinity of the El Labrador and Quitumbe stations of the Quito metro (PLMQ) (Engineering degree work). Indoamerica Technological University. uti.edu.ec

Decentralized Autonomous Government of the Metropolitan District of Quito [GAD DMQ]. (2023). Sustainable Mobility

Master Plan of the Metropolitan District of Quito PMMS 2022-2042. Secretariat of Mobility. quito.gob.ec

Empresa Pública Metropolitana Metro de Quito [EPMMQ]. (2021). Complementary study of the 2.6 km Quitumbe variant of the First Line of the Quito Metro: Executive summary. Ministry of Transport and Public Works. metrodequito.gob.ec

Chamba Tapia, M., Guayaquil Gutierrez, V., Perez Anguasha, B., & Toapanta Martinez,

D. (2025). Project to improve the mobility of the Quitumbe land terminal in the city of Quito [master's thesis, International University of Ecuador]. UIDE Repository. https://repositorio.uide.edu.ec/handle/37000/8348?locale=es

Vega Betancourt, J. (2023). Analysis of urban mobility in the Intillacta and San Luis neighborhoods [Undergraduate/postgraduate thesis, institution as appropriate]. University of the Americas. https://dspace.udla.edu.ec/

Toaquiza Cuchiparte, W. (2023). Evaluation of the standard of transportation-oriented development in the Labrador and Quitumbe stations of the Quito metro, 2023 (Undergraduate thesis, Universidad Tecnológica Indoamérica). https://repositorio.uti.edu.ec/items/5809bb87-fe6e-46f4-8cb7-c028b4454383

UN-Habitat. (2020). The eight principles of transport in urban life. https://onu-habitat.org/index.php/los-ocho-principios-del-transporte-en-la-vida-urbana

Santamen Núñez, L., & Tuero, A. (2021). Transport-oriented development: an assessment of trends and opportunities forLatin America. Inter-American Development Bank.https://publications.iadb.org/es/desarrollo-orientado-al-transporte-una-evaluacion- Trends and Opportunities for Latin America

Caña, G. (2022). The evolution of sustainable mobility in the Metropolitan District of Quito, seen from the operation of the trolleybus corridor [Degree project, Institute of Higher Studies National]. Repository IAEN. https://repositorio.iaen.edu.ec/bitstream/24000/6070/1/Trabajo%20de%20titulaci%c3%b3n%20Giovanna%20Alexandra%20Ca%c3%b1as%20Acu%c3%b1a.pdf